

# CUSTOM MONOLITHIC INTEGRATED CIRCUIT DESIGN AND MANUFACTURING CAPABILITIES

Apr 77



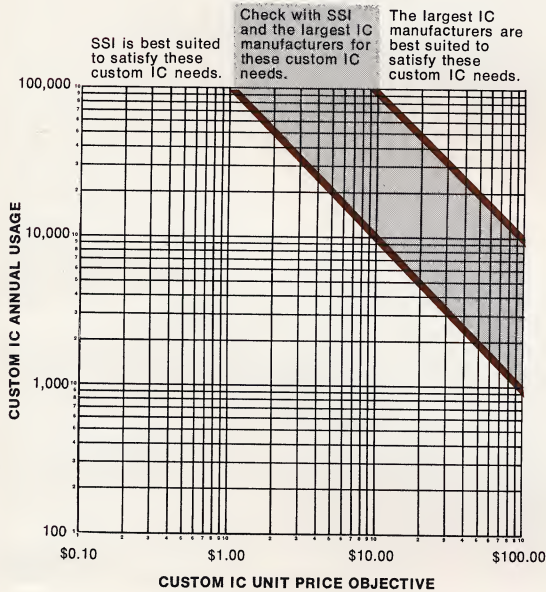
**Silicon Systems**  
incorporated



**A PEOPLE AND IDEAS FIRM . . .  
Offering systems-oriented expertise  
in designing and manufacturing  
custom monolithic integrated  
circuits . . .**

SSI offers full spectrum capabilities, industrial and military, to both "first-time" and established users. We deliver your system ideas and needs in monolithic form.

A monolithic integrated circuit (IC) is a single silicon chip containing up to thousands of electronic components such as transistors, diodes, resistors and capacitors. Monolithic IC's are batch-fabricated, resulting in very low production costs.



Supplier selection graph

SSI selects the optimum standard production IC process in every situation. Thus you are assured the lowest production costs consistent with good availability.

SSI frequently uses Large Scale Integration (LSI) because it offers the greatest complexity and thus the greatest economy. For example, a highly complex LSI IC can often replace from 10 to 100 standard IC's, resulting in the following benefits:

- Reduced assembly cost
- Elimination of one or more printed circuit boards, their guides and connectors
- Reduced incoming component test cost
- Reduced subsystem and final system test cost
- Lower field maintenance and repair cost

and:

- Higher reliability
- Smaller volume
- Reduced weight
- Lower power consumption

SSI's experienced, systems-oriented design group will make an in-depth analysis of your product requirements and will tailor designs to the best technology. This means that maximum production cost savings can be achieved.

The larger IC manufacturers often refuse a contract for a custom development program unless it represents one-half million dollars per circuit per year. If your circuit requirements are not that large, SSI may be the firm best prepared to meet your needs.



An MOS LSI device developed by SSI to replace 30 TTL MSI standard IC's.



A low-noise bipolar amplifier developed by SSI, replacing 90 discrete components.



# Typical Procedures



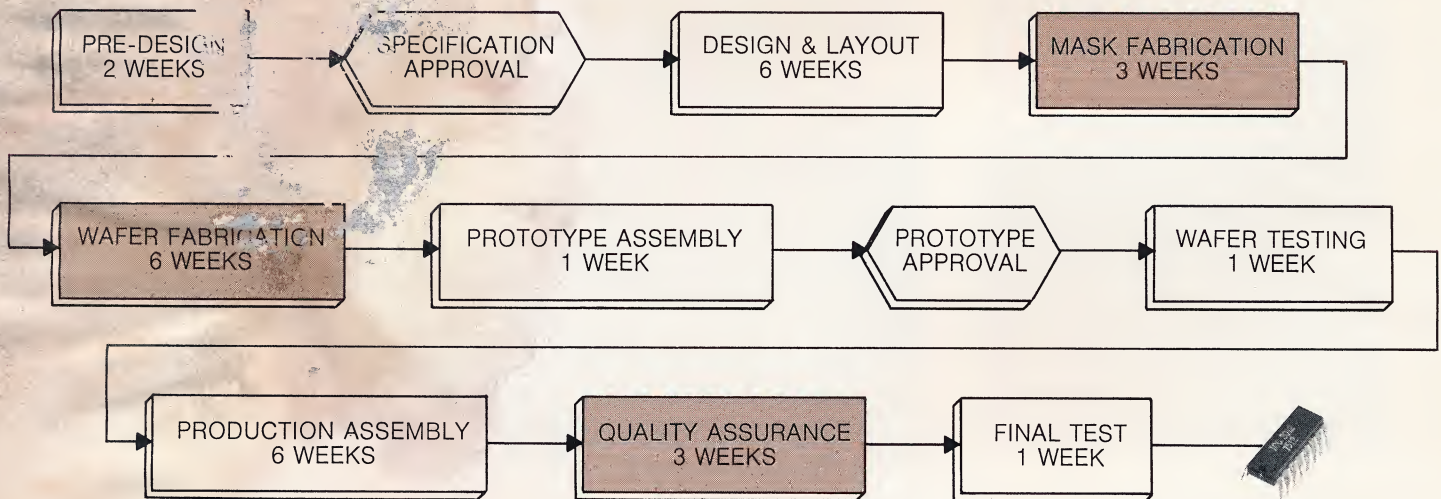
**SSI can deliver an optimum IC because it has the flexibility of using any monolithic process in volume production.**

Most semiconductor companies maintain only a few processes, and while none of these may be ideal for a given application — an adaptation of one may be “adequate”. On the other hand, SSI can supply the optimum IC because it has the flexibility to use any IC technology in volume production.

As a systems-oriented design group, we make an in-depth analysis of the requirements of the finished product; we then establish the most desirable process to be employed.

Different IC processes offer different advantages; choosing the most effective process is the most important early decision to be made in IC development.

The basic steps in IC development and manufacture are:



## TYPICAL DEVELOPMENT SEQUENCE

(Shading indicates steps normally subcontracted.)

# Pre-Design Consultation

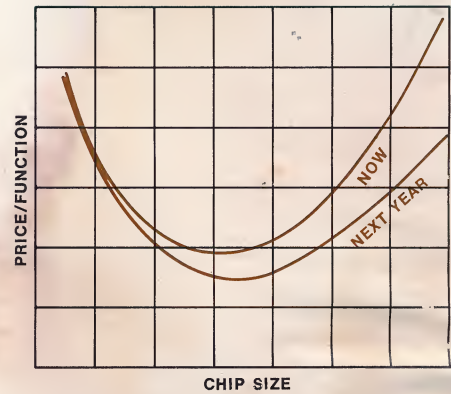
**SSI engineers can conduct a feasibility study to evaluate the merits of a custom IC approach to your system.**

This is the most vital step in IC development, and it must be based on an objective analysis of your product. SSI engineers use their years of design experience to evaluate possible ways for achieving higher levels of system integration. They work closely with the customer to establish the most cost-effective partition of the system electronics. All customer information is held in strictest confidence.

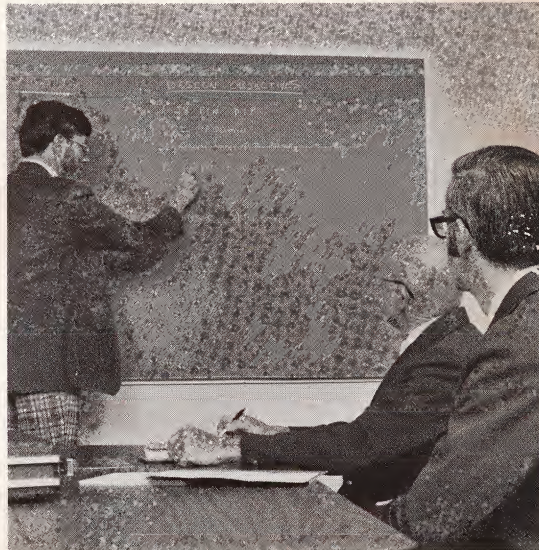
Based on the application and on the production time frame, selection of the semiconductor process is made. The various IC technologies are at different stages of maturity and are developing so rapidly that optimum partitioning changes significantly on a yearly basis.

After partitioning and process selection, a schedule is developed to conform to the customer's requirements and SSI's technical resources.

The pre-design/consultation effort concludes with the presentation of design specifications and a fixed price quotation for development and production of the IC's. These serve as check points before proceeding to the Design Phase.



*Optimum chip size change with time.*

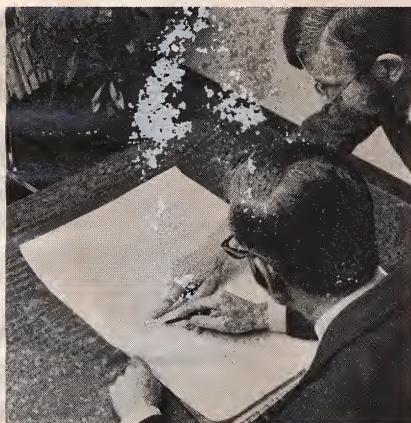


*Customers and SSI staff meet to evaluate custom IC feasibility.*



**SSI combines years of systems know-how with unexcelled computer-aided simulation to create production-ready masks . . . with the first release.**

The actual design procedure varies with the type of IC, performance requirements, and chip complexity. The primary design discipline may be logic design, digital circuit design, or analog circuit design. Or it may be a combination of these in high performance situations.



*Design usually starts with a proposed circuit or logic schematic*



*Designs are simulated for circuit and logical performance*



*Proven designs go through layout phase*

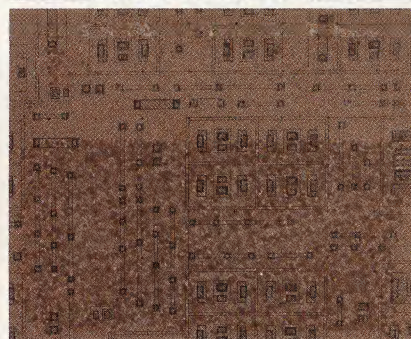
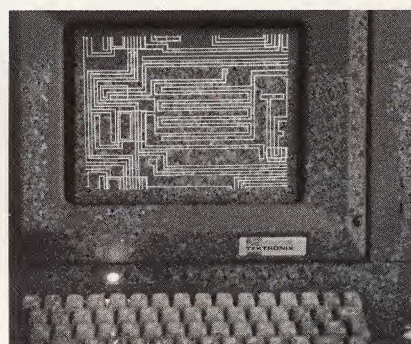
Design work is verified and optimized through use of advanced computerized simulation programs for all design disciplines. These programs are run at SSI's in-house computer center.

As the design becomes finalized, layout commences; then the effects of IC chip layout on circuit design are fed back into the simulation programs. Computerized simulation offers a sure method for both performance evaluation and circuit optimization.



*Layouts are digitized*

At completion, the IC layout is digitized and automatically checked completely for layout rule violations on SSI's interactive graphics system using LAURA (an SSI program for Layout And User Rule Analysis). The error-free layout is output on magnetic tape for delivery to the IC mask supplier.



*Digitized data can be read-out in two ways and automatically checked for layout rule violations*



*Mask-ready layout information is recorded on magnetic tape*

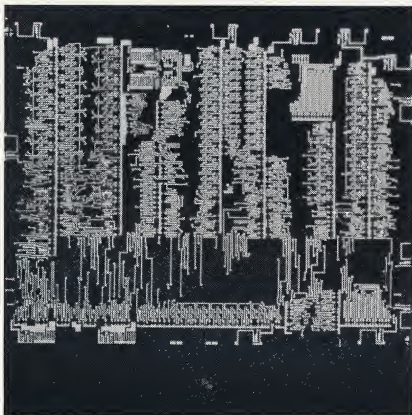


# Processing

**SSI employs precise quality control procedures during these operations to detect flaws and improve yield.**

## MASK FABRICATION

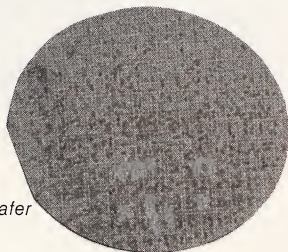
The magnetic tape delivered to the mask supplier (selected at the outset of design) is designed to interface with his automated equipment. A 10x reticle is generated and then used via a step-and-repeat photo reduction process to generate a set of IC photo masks.



*A 10x reticle prepared from magnetic tape*

## WAFER PROCESSING

The completed mask set (designed to be compatible with the process selected at the outset of design) is sent to the wafer fabricator(s). A full run of wafers is made in his production line. The lot of wafers is accepted based upon a generic process test specification, not on circuit tests. The mask set is not released to production until the prototype circuits are thoroughly evaluated and accepted.



*A typical IC wafer*

## PROTOTYPE ASSEMBLY

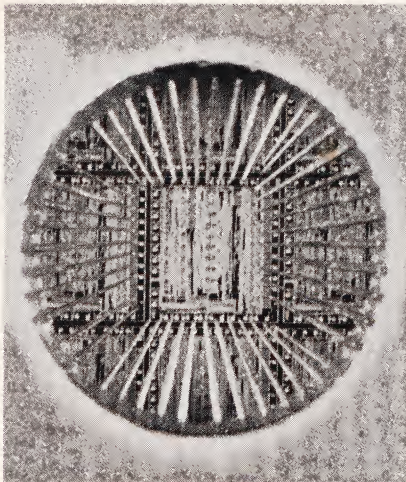
From the prototype wafer run, a small quantity of IC chips is assembled in packages for design verification. These units are thoroughly inspected visually prior to final seal. Then complete testing is done to assure conformance to device specifications. Tested and verified units are delivered to the customer for his approval.



*Test results being reviewed with customer.*

## WAFER TESTING

Wafers are automatically tested on computer-controlled testers, using the individualized test program developed for each IC during its design phase. During wafer testing, each chip is thoroughly tested; bad chips are inked, indicating rejection.



*A wafer being tested to indicate bad chips and monitor yield.*

## PRODUCTION ASSEMBLY

Any standard package in high volume production is available for your IC. SSI will guide you in selecting the best package compatible with your system environmental and reliability requirements. The most popular packages are 8, 16, 28 and 40 pin DIP's (Dual Inline Packages) in high-rel ceramic and epoxy.



*Automatic wire-bonding for high quality*

## QUALITY ASSURANCE

SSI recommends 100% conditioning of assembled IC's prior to final test. For epoxy units, conditioning usually includes thermal cycling and burn-in. For high-rel ceramic packages, conditioning is usually done in accordance with standard MIL requirements including thermal cycling, centrifuge acceleration, hermeticity checks, and burn-in. SSI will assist the customer in selecting the best quality assurance program for each IC.



# Finished Package Final Testing

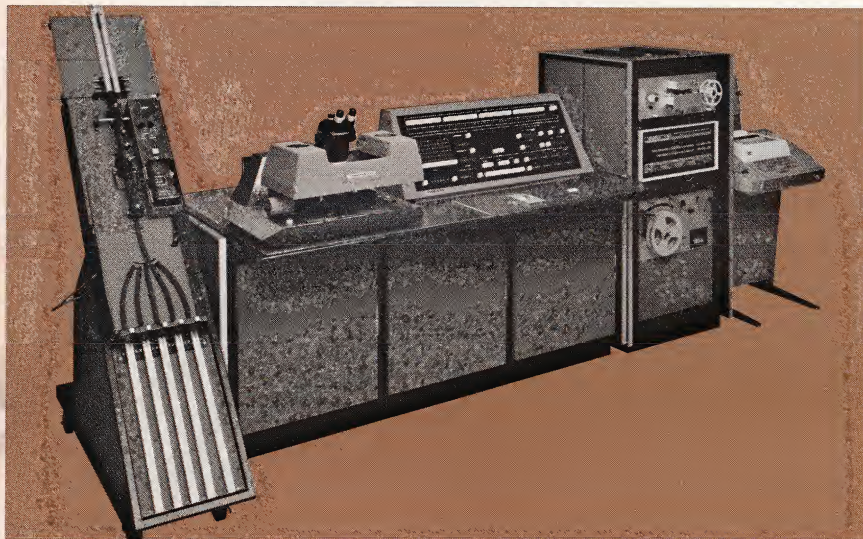


## Complete IC's are 100% tested.

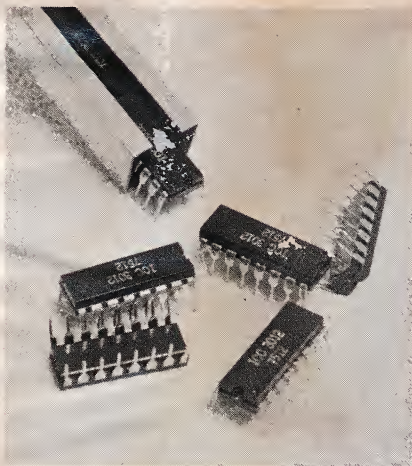
Product verification testing is performed on finished units to determine how well the device specification is being met. Performance margins are established and monitored at the temperature and power supply extremes.

Production circuits are 100% tested to guarantee conformance to the IC specifications.

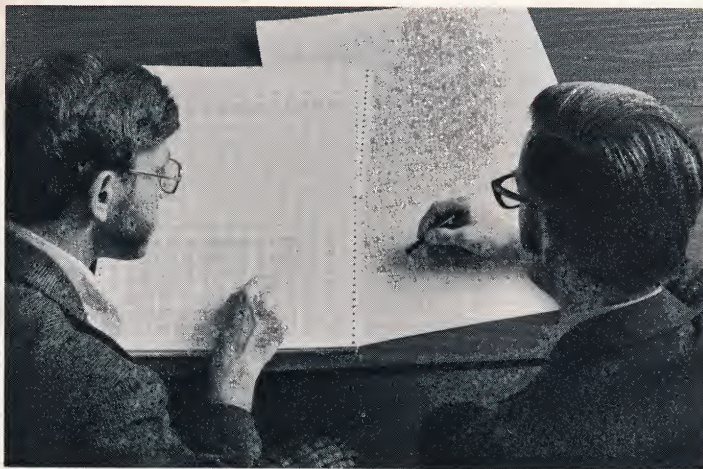
Customers are invited to become familiar with SSI's testing procedures. We aim to make incoming inspection unnecessary for the customer.



*Automatic tester*



*Finished devices and stick carriers*



*Testing procedures being reviewed with customer*



# Service

SSI's system specialists are always available for consultation during production and after delivery.

It is our aim to assist the customer in making the best possible use of IC semiconductor technology.



**Silicon Systems**  
incorporated

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Irvine, California 92714  
Phone: (714) 979-0941





# Silicon Systems incorporated

16692 HALE AVENUE · IRVINE, CALIFORNIA 92714 · (714) 979-0941

March 23, 1977

Mr. T. Nelson  
Box 3  
Schooleys Mountain, N. J. 07870

Dear Mr. Nelson:

We are pleased to receive your request for information. As you know, Silicon Systems specializes in the development and production of custom, monolithic integrated circuits. We handle everything from design through production, take full responsibility, guarantee results, and deliver cost effective custom ICs at any quantity level.

Our highly skilled staff of design engineers supported by our advanced, proprietary design system do system architectural design, logic design, circuit design, and IC layout design. They do design work quickly and correctly (24 of our last 28 designs went into production with the first mask set). And the production yields are the highest in the industry because our computer must verify every design for adherence to all layout rules before we release it. Higher yields mean lower cost to you.

We do linear and digital designs ranging from low-noise amplifiers to microprocessors. No problem is too tough. And usually we can provide extra features at little or no extra device cost. We work with all current production technologies - PMOS, NMOS, and CMOS; as well as gold-doped, Schottky, low-power Schottky, ECL, linear, and I<sup>2</sup>L. We will select the best process for your product, thus insuring the lowest possible cost and risk. Our engineers can start with any type of input, e.g. a general system description, a block diagram, logic diagrams, logic equations, a schematic, or a breadboard. Consequently no special effort is needed to communicate with us.

All our designs are fully protected because custom ICs can't be copied. Therefore you are assured that your competitors won't announce a duplicate product the day after you announce yours. Additionally you will have all the natural benefits